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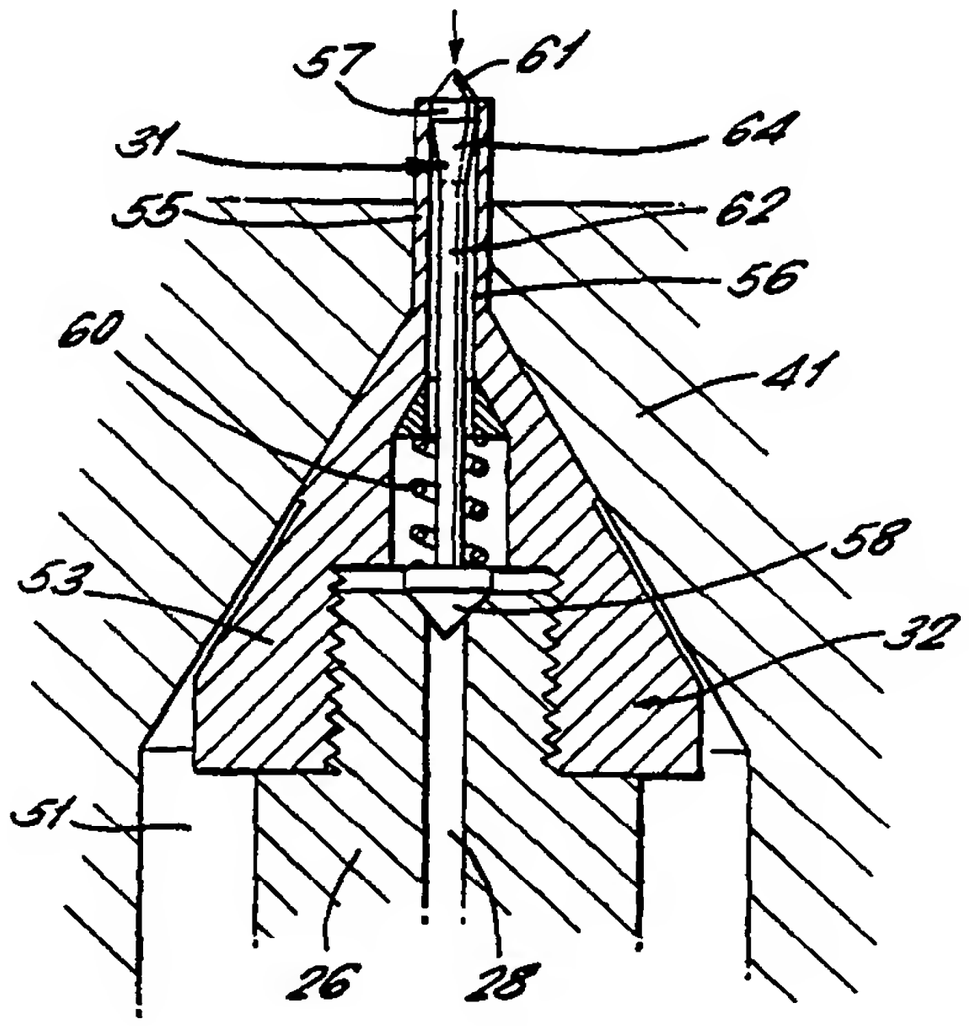
(57) Abstract

The production of an injection moulding of plastics material comprises introducing a supply of plastics material through one or more openings in a mould space, and introducing by means of at least one gas supply passage a pressurised gas through a separate opening (44) in the mould space (13) into the plastics material filling the mould space whereby the gas creates a gas containing cavity (25) in the plastics material. Opening and closing of the gas supply passage (56) is controlled by a valve which is opened by the pressurised gas. The valve comprises a valve port (50) at the outlet end of the gas passage, and a movable valve member (31) extending longitudinally of the gas passage (56) for opening and closing the valve port (50). The valve member (31) at least when in its extended or valve port open position protrudes into the mould space and penetrates the plastics material thereby assisting the gas to enter the plastics material. Also with the valve member (31) in its withdrawn or valve port closed position plastics material is shut off from entering the end of the passage (56) from the mould space.



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METHOD AND APPARATUS FOR INJECTION MOULDING

This invention relates to a method and apparatus for providing an injection moulding of plastics material.

British Patent Specification No. 2202181 describes and claims an apparatus for producing an injection moulding of plastics material comprising means for introducing plastics material into a mould space through one or more openings. Means are also provided for introducing through a separate opening in the mould space a pressurised gas into the plastics material filling the mould space, whereby the gas creates a gas containing cavity in the plastics material, and for thereafter relieving the gas pressure within the gas containing cavity before the mould is opened. The gas supply/pressure relieving means comprises at the separate opening a valve port opening directly into the mould space, a valve member for opening and closing the valve port, and means to supply pressurised gas to the mould space. In operation, the gas supply means is arranged to supply gas through the valve member whilst the valve member is in a valve port closed position, to create the cavity. After the moulding operation has finished, the supply of pressurised gas is terminated and pressurised gas in the cavity in the moulding is vented to the atmosphere by movement of the valve member to a valve port open position. The mould is then opened.

In a preferred embodiment the pressurised gas enters the plastics material through a first passageway in the valve member. Venting of the pressurised gas from the cavity is performed through a

second passageway to the atmosphere, the cavity being connected to the second passageway by withdrawing the valve member from the valve port closed position to the valve port open position. The first and second passageways converge at the opening through which the gas enters the mould space. The valve member is connected to the piston of a piston and cylinder for moving the valve member between its closed and open positions, and is positioned in the second passageway so that when the valve member is withdrawn the pressurised gas passes around the valve member into the second passageway and thereby to the atmosphere. The outlet end of the first passageway in the valve member is defined by a screw on cap containing a non-return valve comprising a captive ball. However, downstream of the ball, there is a short length of the first passageway into which plastics material can enter and which must be cleared by the pressurised gas before the gas penetrates the plastics material to form the cavity.

According to the invention there is provided a method of producing an injection moulding of plastics material comprising introducing a supply of plastics material through one or more openings in a mould space, introducing by means of at least one gas supply passage a pressurised gas through a separate opening in the mould space into the plastics material filling the mould space whereby the gas creates a gas containing cavity in the plastics material, opening and closing of the gas supply passage being controlled by a valve which is opened by the pressurised gas, and thereafter relieving the gas pressure in the cavity before opening the mould, wherein the valve comprises a valve port at the outlet end of the gas passage, and the method includes employing a valve member

extending longitudinally of the gas passage and movable between extended and withdrawn positions for opening and closing the valve port respectively, which valve member at least when in its extended or valve port open position protrudes into the mould space and penetrates the plastics material thereby assisting the gas to enter the plastics material to create the gas containing cavity therein, and whereby with the valve member in its withdrawn or valve port closed position plastics material is shut off from entering the end of the passage from the mould space.

The pressure of the gas preferably moves the valve member into its extended or valve part open position and also maintains the valve member in its extended position.

Preferably the valve member protrudes into the mould space also when in its withdrawn or valve port closed position.

The valve member is preferably spring urged into its valve port closed position.

The invention also provides an apparatus for producing an injection moulding of plastics material comprising means for introducing a supply of plastics material through one or more openings in a mould space, at least one gas supply passage for introducing a pressurised gas through a separate opening in the mould space into the plastics material filling the mould space whereby the gas creates a gas containing cavity in the plastics material, the gas pressure within the cavity thereafter being relieved before the mould is opened, and a control valve for opening and closing the gas supply passage, the valve being opened

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by the pressurised gas, wherein the valve comprises a valve port at the outlet end of the gas passage and a valve member extending longitudinally of the gas passage which is movable between extended and withdrawn positions for opening and closing the valve port respectively, which valve member at least when in its extended or valve port open position protrudes into the mould space and penetrates the plastics material thereby assisting the gas to flow into the plastics material to create the gas containing cavity therein, and whereby with the valve member in its withdrawn or valve port closed position plastics material is shut off from entering the end of the passage from the mould space.

The valve member preferably has a head for closing the valve port, the head being tapered to assist the valve member to penetrate the plastics material.

A spring is preferably provided which urges the valve member into its valve port closed position.

Preferably the valve member when in its valve part closed position engages a stop whereby the plastics material filling the mould space cannot retract the valve member further into the gas supply passage.

In the preferred embodiment of the invention the gas supply means is combined with means for relieving the gas pressure within the gas containing cavity before the mould is opened, said combined gas supply/pressure relieving means comprising at said separate opening a second valve port opening directly into the mould space, and a second valve member for

opening and closing the second valve port, said second valve member containing said gas supply passage through which gas enters the mould space whilst the second valve member is in a position closing the second valve port, the second valve member subsequently being moved to open the second valve port to effect venting of the cavity through a second passage to the atmosphere due to movement of the second valve member to open the second valve port.

Preferably said first and second passages converge at the opening through which the gas enters the mould space. The second passage preferably contains the second valve member whereby when the second valve member is opened the pressurised gas passes around the second valve member into the second passage and thereby to the atmosphere.

It is also preferred that the second valve member is connected to the piston of a piston and cylinder for moving the second valve member between its valve port closed and valve port open positions.

By way of example, a specific embodiment in accordance with the invention will be described with reference to the accompanying drawings in which:-

Figure 1 shows an injection moulding machine having a hot runner manifold;

Figure 2 is a detail sectional view of the rectractable gas supply nozzle having a passage through which pressurised gas enters the plastics material in the mould space, the nozzle being in its valve port closed position, and the shut-off valve member in the passage of the nozzle being in its withdrawn or valve port closed position;

Figure 3 shows the shut-off valve member extended by the gas pressure into its valve port open position to allow gas to enter the plastics material in the mould space; and

Figure 4 shows the gas supply nozzle retracted for venting of the cavity.

This example concerns an apparatus for producing injection mouldings of plastics material which is based on the apparatus illustrated in Figure 1 of British Patent Specification No. 2202181. Also, in general terms, the process of injection moulding is the same as described in that prior specification.

More particularly, a mould 9 of an injection moulding machine has upper and lower parts 11, 12 defining a mould space 13 of complex design and incorporating a rib 16. The mould parts 11, 12 are mounted between a fixed upper platen 10 and a lower platen 14 movable by a hydraulic ram 15. Also, in this embodiment, within the upper mould part 11 is a hot runner manifold 17 leading to a desired point of entry or opening 43 to the mould space 13.

A screw ram 18 is provided for introducing molten thermoplastic material 19 through a nozzle assembly 20 to the hot runner manifold 17 and hence through the opening 43 into the mould space 13. The nozzle assembly is provided with a shut-off slide valve 21 activated by a bell-crank lever 22 and a link 23 connected to a hydraulic cylinder 24. The valve 21 is shown in its closed position at the end of that part of the moulding cycle which includes the introduction of the plastics material. The closed valve 24 prevents any back flow of plastics material to the barrel of the screw ram, which may then be refilled

with plastics material in preparation for the next moulding cycle.

The passage through which pressurised gas is introduced to create a gas containing cavity 25 in the plastics material 19 is the bore 28 of a retractable gas supply nozzle or valve member 26 connected to the piston 29 of a hydraulic or pneumatic cylinder 27. The downstream end of the nozzle 26 is located at a separate opening 44 in the mould space and includes a shut-off control valve comprising an axially movable valve member 31 which is held captive by a screw-on cap 32 and which will be described in detail below with reference to Figures 2 to 4. Pressurised gas, e.g. nitrogen, is supplied to the upstream end of the nozzle 26 from a chamber 35 by a piston and cylinder 33, 34. The chamber 35 is connected to the nozzle 26 via a solenoid operated valve 36, and to a gas supply (not shown) via a non-return valve 37 and a pressure regulator 38.

Surrounding the nozzle 26 is a second passage 51 which adjacent its inner end has a valve port 42 connected by a short passageway 52 leading to the opening 44 in the mould space 13, and provided in this embodiment by an insert 41 in the lower mould part 12. Also, in this embodiment, the outer end of the passage 51 is open to the atmosphere.

The screw-on cap 32 of the nozzle 26 comprises a frusto-conical part 53 providing an externally tapered surface 63 capable of sealing engagement with a conical valve seat 54 of the valve port 42, and a leading cylindrical part 55 adapted, in this embodiment, to protrude into the mould space through the short passageway 52. The extent to which the part

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55 protrudes into the mould space when the valve port 42 is closed may be varied, or indeed the end of the part 55 may be substantially flush with the mould surface. Within a bore 56 in the cap 32 through which gas enters the mould space, there is positioned the movable valve member 31 of the shut-off valve, which valve member 31 extends longitudinally of the bore 56 which is a continuation of the bore 28 of the nozzle. At the leading end of the valve member 31 there is provided a head 57 which when the valve member 31 is withdrawn seats in a valve port 50 defined by the outlet end of the bore 56 and thereby shuts off the outlet end of the bore 56 against the ingress of plastics material filling the mould space. The head 57 also has a protruding tapered end portion, which, in this embodiment, is a cone 61, for piercing the skin of the plastics material and penetrating further into the plastics material, thereby assisting the gas to enter the plastics material to create the required cavity. The head 57 is connected to the stem 62 of the member 31 by a section 64 having a reverse taper. This section 64 assists to align the head 57 to close the valve port 50 in the outlet end of the bore 56 when the member is drawn therein. The valve member 31 also has a diamond shaped head 58 at its trailing end for engagement with a countersink surface 59 at the outlet end of the bore 28 in the nozzle 26 which stops the member 31 being withdrawn further without fully blocking off the passage 28. The valve member 31 acts as a shuttle within the bore 56 between a withdrawn position (Figure 2), in which the trailing head 58 abuts the countersink surface 59 and the leading head 57 closes the valve port 50 in the outlet end of the bore 56, and an extended position (Figure 3) in which the cone 61 and the head 57 penetrate the plastics material and the pressurised gas is permitted to flow

through the passage formed by bores 28, 56 in series into the plastics material within the mould space 13. In both positions of the valve member 31, at least the cone 61 of the valve member protrudes into the mould space 13. A spring 60 initially urges the valve member 31 into its withdrawn or valve port closed position but can be overcome by the gas pressure when the pressurised gas is permitted to flow into the bore 28, the diamond shaped head 58 increasing the surface area against which the gas acts and allowing the gas pressure to be applied to the surface of the reverse tapered section 64. When the valve member 31 is moved by the gas pressure into its extended or valve port open position, the valve member protrudes further into the mould space 13 and penetrates deeper into the plastics material thereby assisting the pressurised gas to enter the plastics material.

The piston and cylinder 29, 27 is controlled via a solenoid operated valve 40 by control means (not shown) to move the nozzle 26 between a forward position (Figures 1 to 3) and a withdrawn position (Figure 4). In the forward position, the frusto-conical part 53 of the cap 32 of the nozzle or valve member 26 closes the valve port 42 and the cylindrical part 55 of the cap extends into the passageway 52. The pressure applied by the piston 29 is greater than the pressure applied by the plastics material within the mould space 13 and the back pressure of the gas which is creating the gas containing cavity 25. In the withdrawn or valve port open position of the nozzle or valve member 26, gas pressure within the cavity 25 is relieved through the opening 44, i.e. gas from the cavity readily passes through the passageway 52, the valve port 42 and the passageway 51 in succession and thereby around the

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nozzle 26 to the atmosphere. The valve member 31 has then been returned to its withdrawn or valve port closed position by the spring 60 and the head 57 prevents the gas passing back through the bore 56.

In operation, at the start of the moulding cycle the nozzle or valve member 26 is held forward under pressure by the piston and cylinder 29, 27 thereby closing the valve port 42, and the valve member 31 is spring urged into its withdrawn or valve port closed position (Figure 2). The screw ram 18 contains plastics material and the slide valve 21 is open. The chamber 35 is also filled with pressurised gas, and the valves 36 and 39 are both closed.

Operation of the screw ram 18 introduces the plastics material 19 into the mould space 13 through the opening 43 via the hot runner manifold 17. Simultaneously, a gas delay timer is started. At the end of this delay time, the outlet end of the nozzle 26 is covered by plastics material, but the valve member 31 is still withdrawn in its valve port closed position preventing the ingress of plastics material into the bore 56. The valve 36 is then opened and the piston and cylinder 33, 34 is operated to introduce gas through the nozzle 26. The pressurised gas moves the valve member 31 into its extended or valve port open position (Figure 3) in which the cone 61 and the leading head 57 of the valve member 31 penetrate further the plastics material. The gas then flows through the bores 28, 56 into the plastics material within the mould space to create a gas containing cavity 25 in the plastics material. The pressurisation in the gas is maintained by the piston and cylinder 33, 34 whereby the gas in the plastics material causes the plastics material to flow

throughout the mould space with the gas containing cavity within the plastics material, the cavity thereby extending with the plastics material until the plastics material has extended over the whole of the mould space. The gas flow pressure to the cavity 25 is also maintained to hold the plastics material in the mould space positively against the mould surface as the plastics material solidifies and cools until the moulding can itself sustain the form dictated by the mould surface.

The valve 36 is closed and the piston 33 withdrawn. The cylinder 34 may be refilled with another quantity of gas under pressure.

The valve member 31 is returned by the spring 60 to its withdrawn or valve port closed position, the reverse tapered section 64 aligning the head 57 to enter the bore 56.

Furthermore, the valve 40 is reversed so that the piston 29 withdraws the nozzle 26 to open the valve port 42, the gas in the gas containing cavity passing out through the opening 44, the open valve port 42, and the second passageway 51 to the atmosphere (Figure 4), thereby relieving the gas pressure in the cavity 25. The mould is then opened and the moulding removed. Finally, the piston and cylinder 29, 30 is operated to return the nozzle 26 to its forward position (Figure 2) to await the introduction of plastics material during the next moulding cycle.

It will be appreciated that the leading head 57 of the valve member 31 effectively prevents the passage 56 through which pressurised gas is introduced into the plastics material filling the mould space,

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from becoming blocked by the plastics material.

Also, the fact that the head 57 of the valve member 31 acts to pierce the skin of the plastics material and that the valve member, at least when in its extended or valve port open position, protrudes into the mould space and penetrates the plastics material assists the pressurised gas to enter the plastics material to create the required cavity. Otherwise, at least some of the gas might tend to flow back over the surface of the plastics material, i.e. between the plastics material and the mould surface, which would be detrimental to the surface finish of the moulding. This possibility is also further avoided, in the case of the present embodiment, by the cylindrical part 55 of the cap 32 protruding into the mould space 13 (see Figure 3) during the introduction of the gas.

The invention is not restricted to the specific details of the embodiment described above. For example, there may be provided a retractable nozzle 26 of the kind described at different positions or at more than one position in the mould, in the same manner as described in relation to the embodiments of Figures 4 to 9 of British Patent Specification No. 2202181. Similarly, as described in the same prior specification, two or more openings may be provided through which the molten plastics material enters the mould space 13.

CLAIMS

1. A method of producing an injection moulding of plastics material comprising introducing a supply of plastics material through one or more openings in a mould space, introducing by means of at least one gas supply passage a pressurised gas through a separate opening in the mould space into the plastics material filling the mould space whereby the gas creates a gas containing cavity in the plastics material, opening and closing of the gas supply passage being controlled by a valve which is opened by the pressurised gas, and thereafter relieving the gas pressure in the cavity before opening the mould, wherein the valve comprises a valve port at the outlet end of the gas passage, and the method includes employing a valve member extending longitudinally of the gas passage and movable between extended and withdrawn positions for opening and closing the valve port respectively, which valve member at least when in its extended or valve port open position protrudes into the mould space and penetrates the plastics material thereby assisting the gas to enter the plastics material to create the gas containing cavity therein, and whereby with the valve member in its withdrawn or valve port closed position plastics material is shut off from entering the end of the passage from the mould space.

2. A method as claimed in Claim 1, wherein the pressure of the gas moves the valve member into its extended or valve port open position and also maintains the valve member in its extended position.

3. A method as claimed in any one of the preceding claims, wherein the valve member protrudes into the

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mould space also when in its withdrawn or valve port closed position.

4. A method as claimed in any one of the preceding claims, wherein the valve member is spring urged into its valve port closed position.

5. Apparatus for producing an injection moulding of plastics material comprising means for introducing a supply of plastics material through one or more openings in a mould space, at least one gas supply passage for introducing a pressurised gas through a separate opening in the mould space into the plastics material filling the mould space whereby the gas creates a gas containing cavity in the plastics material, the gas pressure within the cavity thereafter being relieved before the mould is opened, and a control valve for opening and closing the gas supply passage, the valve being opened by the pressurised gas, wherein the valve comprises a valve port at the outlet end of the gas passage and a valve member extending longitudinally of the gas passage which is movable between extended and withdrawn positions for opening and closing the valve port respectively, which valve member at least when in its extended or valve port open position protrudes into the mould space and penetrates the plastics material thereby assisting the gas to flow into the plastics material to create the gas containing cavity therein, and whereby with the valve member in its withdrawn or valve port closed position plastics material is shut off from entering the end of the passage from the mould space.

6. Apparatus as claimed in Claim 5, wherein the valve member has a head for closing the valve port,

the head being tapered to assist the valve member to penetrate the plastics material.

7. Apparatus as claimed in Claim 5 or Claim 6, wherein the valve member protrudes into the mould space also when in its valve port closed position.

8. Apparatus as claimed in any one of Claims 5 to 7, wherein a spring is provided which urges the valve member into its valve port closed position.

9. Apparatus as claimed in any one of Claims 6 to 8, wherein the valve member when in its valve port closed position engages a stop whereby the plastics material filling the mould space cannot retract the valve member further into the gas supply passage.

10. Apparatus as claimed in any one of Claims 5 to 9, wherein the gas supply means is combined with means for relieving the gas pressure within the gas containing cavity before the mould is opened, said combined gas supply/pressure relieving means comprising at said separate opening a second valve port opening directly into the mould space, and a second valve member for opening and closing the second valve port, said second valve member containing said gas supply passage through which gas enters the mould space whilst the second valve member is in a position closing the second valve port, the second valve member subsequently being moved to open the second valve port to effect venting of the cavity through a second passage to the atmosphere due to movement of the second valve member to open the second valve port.

11. Apparatus as claimed in Claim 10, wherein said first and second passages converge at the opening

through which the gas enters the mould space.

12. Apparatus as claimed in Claim 10 or Claim 11, wherein the second passage contains the second valve member whereby when the second valve member is opened the pressurised gas passes around the second valve member into the second passage and thereby to the atmosphere.

13. Apparatus as claimed in any one of Claims 10 to 12, wherein the second valve member is connected to the piston of a piston and cylinder for moving the second valve member between its valve port closed and valve port open positions.

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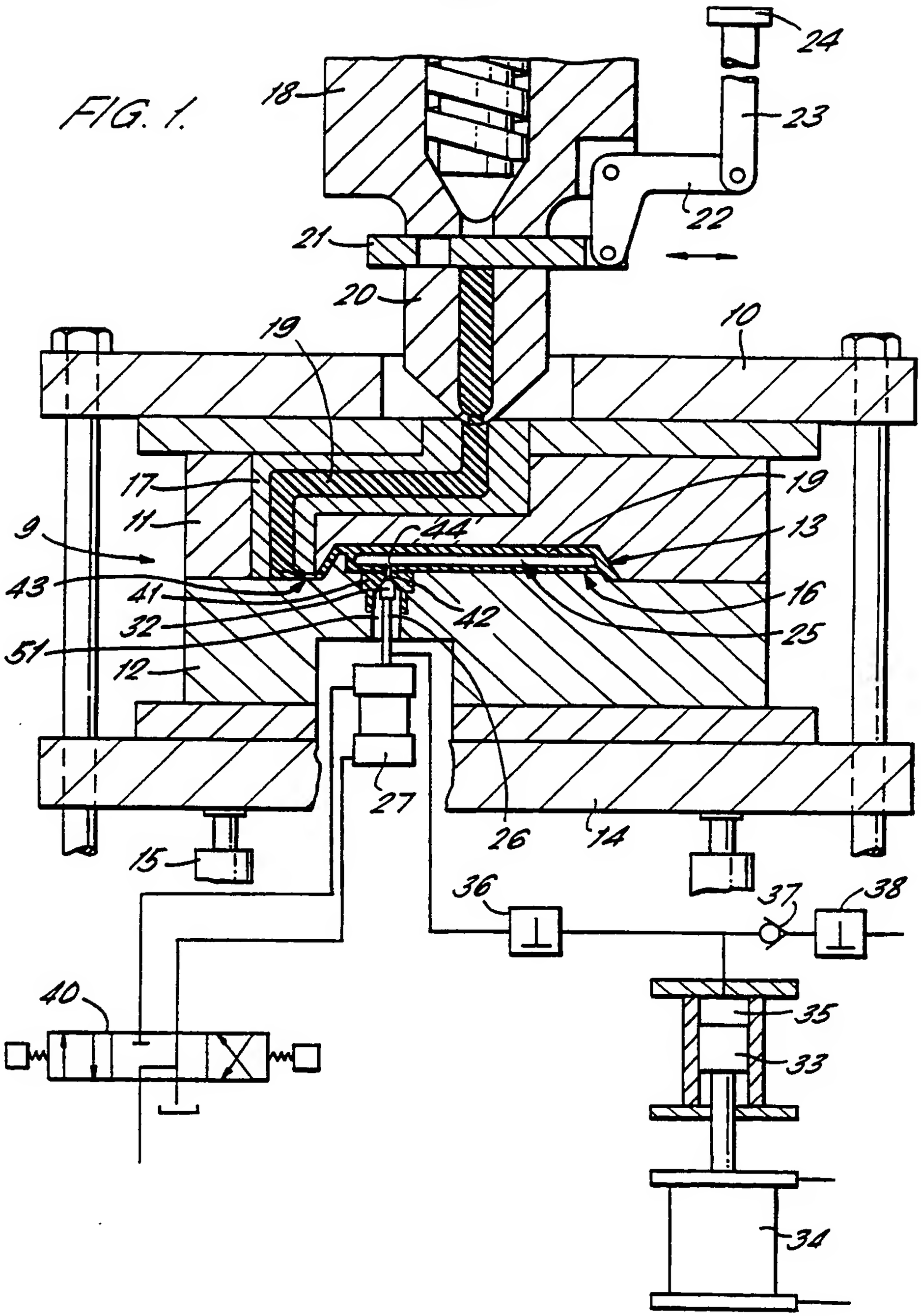
FIG. 1.



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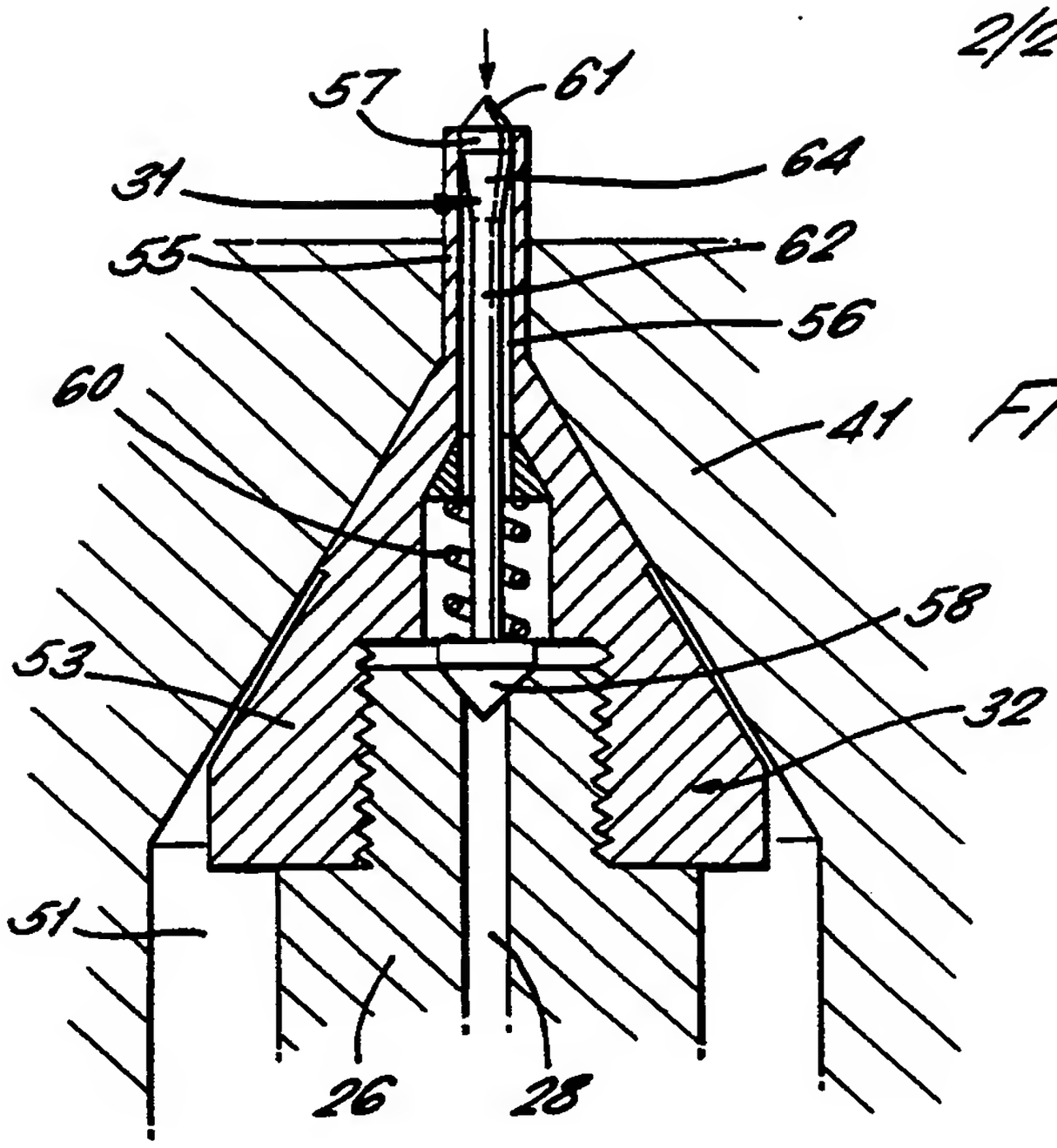

FIG. 2.

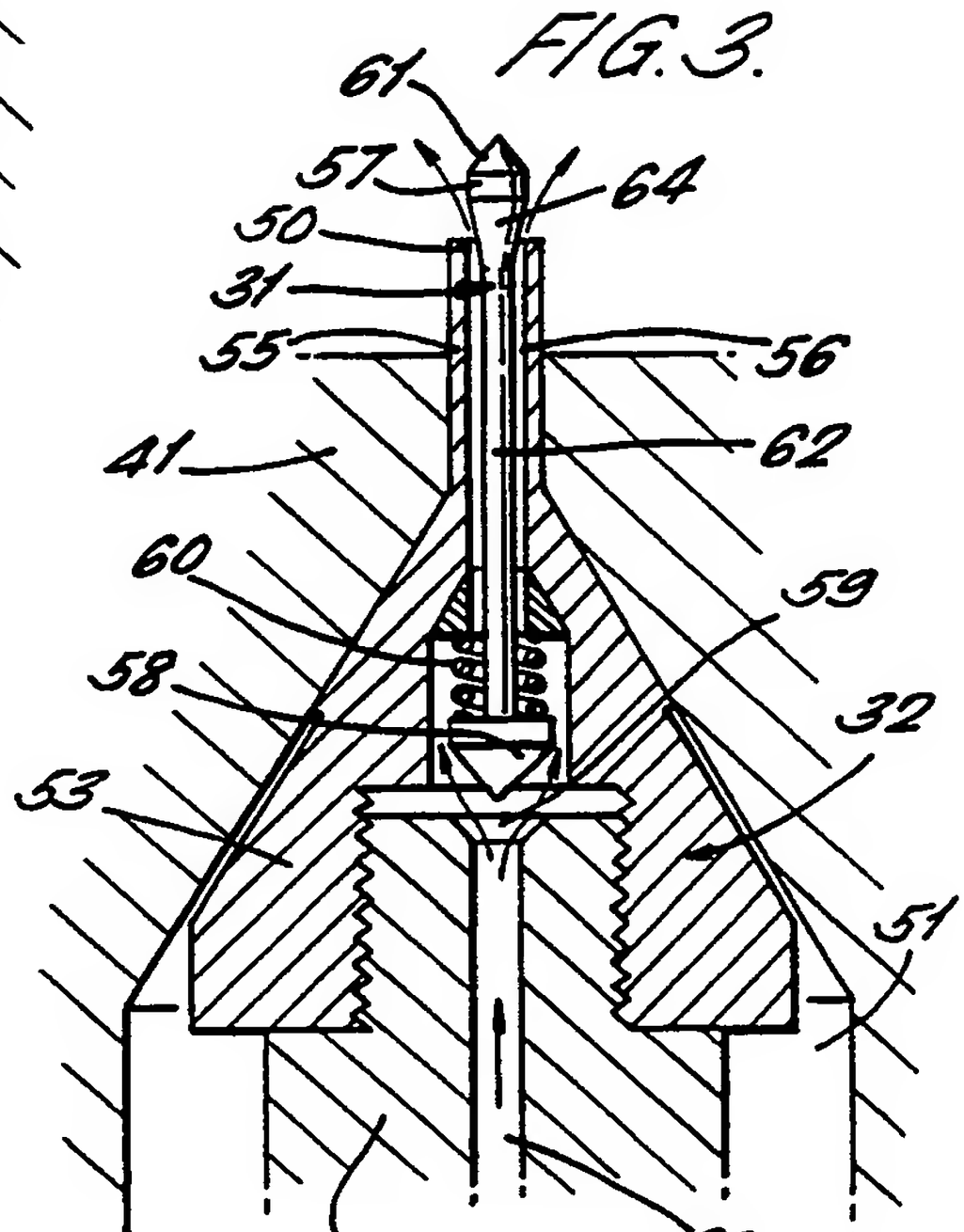

FIG. 3.

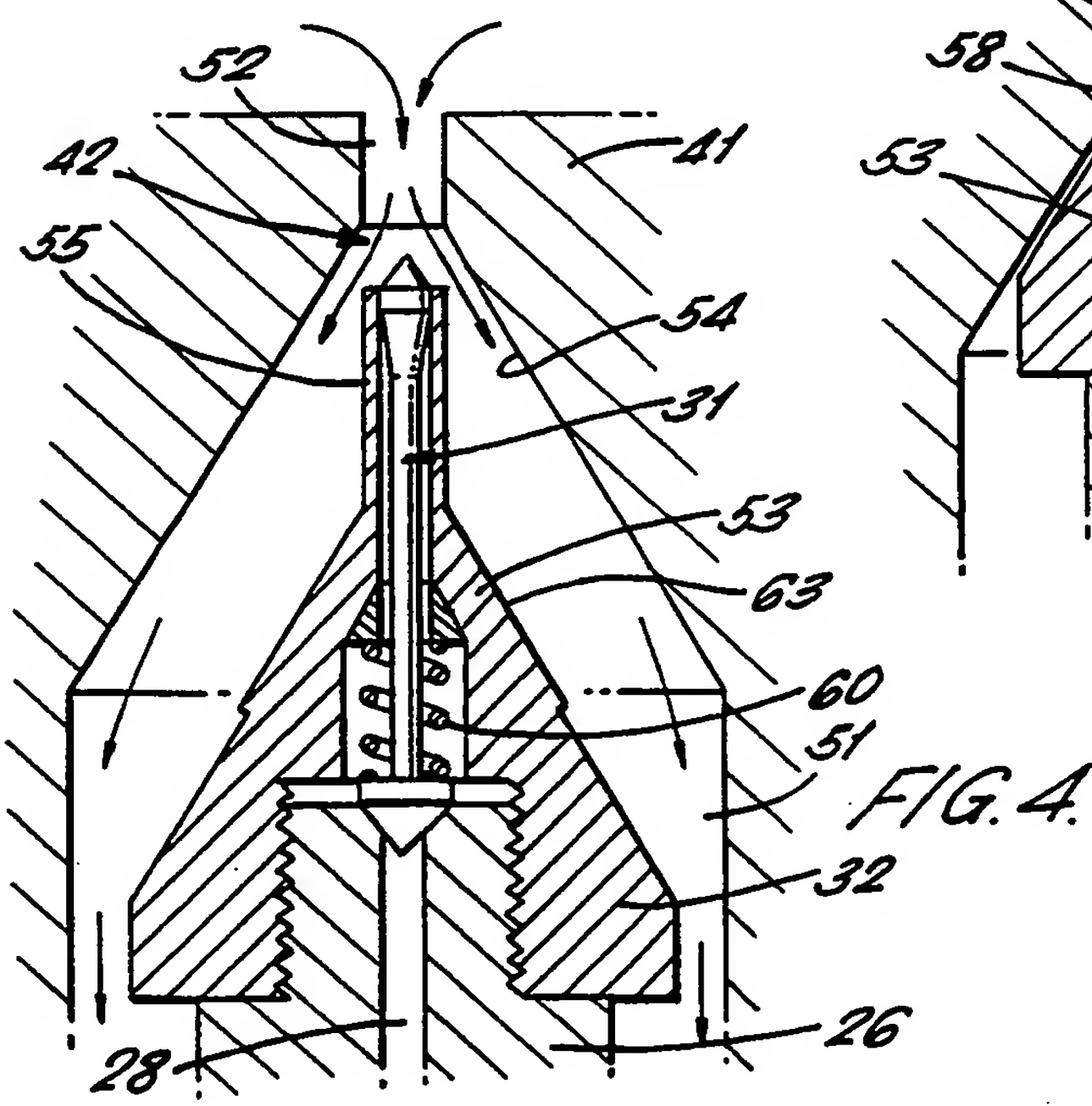

FIG. 4.

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INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 93/01008

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]
According to International Patent Classification (IPC) or to both National Classification and IPC Int.Cl. 5 B29C45/17

II. FIELDS SEARCHED	
Minimum Documentation Searched[7]	
Classification System	Classification Symbols
Int.Cl. 5	B29C
Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched[8]	

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	EP,A,0 283 207 (CINPRES) 21 September 1988 cited in the application see the whole document	1,5, 10-13
A	EP,A,0 390 068 (KRAUSS-MAFFEI) 3 October 1990 see the whole document	1,2,4,5, 8
A	EP,A,0 435 025 (ZIEGLER) 3 July 1991 see the whole document	1,5,6
A	DE,A,3 936 289 (BATTENFELD) 2 May 1991 see column 5, line 32 - column 7, line 23; figures 2,3	1,5,6

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IV. CERTIFICATION	
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
19 AUGUST 1993	08 -09- 1993
International Searching Authority	Signature of Authorized Officer
EUR PEAN PATENT OFFICE	BOLLEN J.A.G.

Form PCT/ISA/210 (second sheet) (January 1985)

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

GB 9301008
SA 73958

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP-A-0283207	21-09-88	AU-B-	591385	30-11-89
		AU-A-	1315088	15-09-88
		CA-A-	1280859	05-03-91
		DE-A-	3870684	11-06-92
		GB-A,B	2202181	21-09-88
		JP-A-	1014012	18-01-89
		US-A-	4740150	26-04-88
EP-A-0390068	03-10-90	DE-A-	3910025	04-10-90
		CA-A-	2013320	28-09-90
		JP-A-	2281923	19-11-90
		US-A-	5101858	07-04-92
		US-A-	5222514	29-06-93
EP-A-0435025	03-07-91	DE-A-	3942957	11-07-91
		JP-A-	4041212	12-02-92
		US-A-	5162230	10-11-92
DE-A-3936289	02-05-91	AT-B-	395555	25-01-93
		JP-A-	3164222	16-07-91

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